Claims

1. A clamping apparatus which detachably fixes a movable member (M) to a reference member (R), wherein

an annular plug portion (21) projects from the reference member (R) toward a leading end direction, and a tapered outer peripheral surface (28, 54) which narrows toward the leading end direction is arranged on the outer peripheral side of the plug portion (21), and the movable member (M) is provided with a tapered inner peripheral surface (12, 53) which engages with the tapered outer peripheral surface (28, 54),

a transmission member (29) is supported by a leading end of a cylindrical hole (21a) of the plug portion (21) so as to be axially movable within a predetermined range, while a rod (31) is inserted in the cylindrical hole (21a) so as to be axially movable, the latter located in a position closer to the reference member (R) than the transmission member (29),

in the clamping operation, the rod (31) is driven toward a base end direction to the reference member (R) by a driving means (D) which is provided in the reference member (R), and an output portion (36) of the rod (31) moves the movable member (M) toward the reference member (R), and a transmission gap (G) is formed between a pushing portion (31a) of a leading end of the rod (31) and a pressure receiving portion (29b) of the transmission member (29),

in the unclamping operation, the rod (31) is driven toward the leading end direction by the driving means (D), and the pushing portion (31a) of the rod (31) pushes the movable member (M) through the transmission member (29).

2. The clamping apparatus as set forth in claim 1 wherein,

in the unclamping operation, the rod (31) pushes the movable member (M) through the transmission member (29) to form a fitting gap (alpha) between the tapered outer peripheral surface (28, 54) and the tapered inner peripheral surface (12, 53).

3. The clamping apparatus as set forth in claim 1 or 2 wherein,

an annular shuttle member (23), which diametrically

expands and contracts, is provided with its inner peripheral surface fitted onto the plug portion (21) so as to axially reciprocate within a predetermined range, while the outer peripheral surface of the shuttle member (23) serving as the tapered outer peripheral surface (28), and

an advancing means (24) is provided to move the shuttle member (23) in such a direction as to tighten the tapering engagement.

4. The clamping apparatus as set forth in claim 1 or 2 wherein,

an annular shuttle member (23), which diametrically expands and contracts, is provided with an outer peripheral surface fitted into the movable member (M) so as to axially reciprocate within a predetermined range, while the inner peripheral surface of the shuttle member (23) serving as the tapered inner peripheral surface (53), and

an advancing means (24) is provided to move the shuttle member (23) in such a direction as to tighten the tapering engagement.

5. A clamping apparatus which fixes a surface (T) to be supported of a movable member (M) to a support surface (S) of a reference member (R) by aligning the movable member (M) with the reference member (R), wherein

a socket bore (11) is opened in the surface (T) to be supported of the movable member (M) to form a positioning hole (12) and an engaging hole (13) in this order from the opening edge of the socket bore (11),

an annular plug portion (21) which is to be inserted into the socket bore (11) is projected from the reference member (R) toward a leading end direction,

a shuttle member (23), which diametrically expands and contracts, is arranged between the plug portion (21) and the positioning hole (12), and the shuttle member (23) is supported by either the plug portion (21) or the positioning hole (12) so as to axially reciprocate within a predetermined range, and the shuttle member (23) makes a tapering engagement with the other, and a tapered surface (28, 53) of the shuttle member (23) is formed to narrow toward the engaging hole (13),

and an advancing means (24) is provided to move the shuttle member (23) in such a direction as to tighten the tapering engagement,

a transmission member (29) is supported by a leading end of a cylindrical hole (21a) of the plug portion (21) so as to be axially movable within a predetermined range, while a rod (31) is inserted into the cylindrical hole (21a) so as to be axially movable, the latter located in a position closer to the reference member (R) than the transmission member (29), and an engaging member (34), which is movable between a radially outward engaging position (X) and a radially inward disengaging position (Y), is arranged in the outer peripheral space of the rod (31),

in the clamping operation, a driving means (D) provided in the reference member (R) drives the rod (31) in a direction toward a base end direction to the reference member (R), thereby enabling an output portion (36) of the rod (31) to switch over the engaging member (34) to the engaging position (X) for engaging the engaging member (34) with the engaging hole (13) to move the movable member (M) toward the reference member (R), and a transmission gap (G) is formed between a pushing portion (31a) of a leading end of the rod (31) and a pressure receiving portion (29b) of the transmission member (29),

in the unclamping operation, the driving means (D) drives the rod (31) toward the leading end direction, thereby allowing the engaging member (34) to switch over to the disengaging position (Y), so that the pushing portion (31a) of the rod (31) pushes a top wall (11a) of the socket bore (11) through the transmission member (29).

6. The clamping apparatus as set forth in claim 5 wherein,

In the unclamping operation, the rod (31) pushes the movable member (M) through the transmission member (29) to form a fitting gap (alpha) on the tapered surface (28,53) of the shuttle member (23) and a contact gap (beta) between the support surface (S) and the surface (T) to be supported.

7. The clamping apparatus as set forth in any one of claims 1

through 6 wherein,

a resilient member (32) is disposed between the rod (31) and the transmission member (29) to urge the transmission member (29) toward the leading end direction.

8. The clamping apparatus as set forth in any one of claims 1 through 7 wherein,

the reference member (R) is provided with a supply port (41) for a cleaning fluid, while the transmission member (29) is provided with a blowout hole (42) for the cleaning fluid, and the rod (31) is provided with a flow passage (44) through which the supply port (41) and the blowout hole (42) communicate with each other.